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ABSTRACT

A study examined the relationship between education and training and changes to farm management practices that improve profitability. Data were drawn from a National Australian survey of 2,500 farms and from an interview survey of 65 Tasmanian farms, 45 of which had participated in recent training. Findings indicate that farms that participated in training were more likely to make changes that improved profitability. Education and training impacted the farm business via managers' greater awareness of possible innovations, via improved decision making and allocation of resources, and via attitudes that encourage change. Most changes to practice were influenced by interaction with, and information from, multiple sources, including peers, experts, and training events. Family, staff, and other farmers were relatively more important in prompting change for farm managers with no postsecondary educational qualifications. Expert advisers, other farmers, and training events were major sources of awareness of subsequently implemented strategies and practices, as well as major sources of influence on the decision to change. Interaction with peers, family, and friends facilitated changes in values, attitudes, and beliefs, and may be necessary before change can occur. Education and training influences promoted change by delivering new knowledge and skills and by providing opportunities for interaction with experts and peers. Education and training programs designed to encourage interaction and sharing of knowledge and skills were most likely to facilitate changes in farm businesses, especially to complex practices such as financial and land management. (Contains 41 references.) (TD)

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Education and training: Impacts on farm management practice

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Abstract

This paper presents the results of a large Australia-wide survey which collected farm financial information and information about changes to farm management practices, as well as information about education and training, and a smaller survey of farmers who attended one of three training courses for farmers. The paper considers the relationship between education and training outcomes on macro and micro levels. At the macro level, education and training and propensity to change is considered, while at the micro level the influence of training on changes to practice is examined. Education and training enhance farmers' ability and willingness to make successful changes to their management practice. The training program is generally only one of several factors which influence participants to make changes to their practice following the program. Training events are opportunities for interaction between participants and with expert trainers. This interaction assists in altering values and attitudes toward new practices.

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Background

The Australian National Farmers' Federation identifies establishment of a training culture and increased participation in management training as priorities in its strategy document *New Horizons: A Strategy for Australia's Agrifood Industries* (National Farmers' Federation, 1993). The National Farmers' Federation stresses the need for training and flexibility in order for the agricultural sector to remain internationally competitive.

> ... the skills required of farmers in the past in order to succeed in agriculture will in future need to be supplemented with additional skills in order to cope with the changes that have emerged over recent decades. Good technical skills in crop and livestock husbandry will need to be supported with skills in financial management.... and with skills in risk management. This is not to say that good technical skills are of any less importance than in the past, but in the future, additional skills will be pivotal to the survival of farm businesses.... (National Farmers Federation, 1993, 75-76).

The kinds of changes which industry leaders from farmer organisations, product purchasing companies and government would like farmers to make are: improved business/risk management, implementation of quality assurance, use of environmentally sustainable agricultural practices and changes which can be summarised as moving from farming as a 'way-of-life' to farming as a business (New South Wales Primary Industries Training Body Ltd, 1998; Department of Primary Industries and Energy, 1997; Queensland Department of Primary Industries, 1997; Kilpatrick, 1996b; National Farmers Federation, 1993). Technical changes such as use of global positioning and planting of new seed varieties are seen as much less important to the future of agriculture in Australia than changes to the way farm businesses are managed.

Recent policy initiatives in farm management training confirm a strongly held belief amongst the leading section of the agricultural industry that education and training are essential for managing and promoting the changes that must occur if farm businesses are to be viable and sustainable in the twenty-first century (Anderson, 1997). Australian agriculture operates in a climate of change. The Australian government has a free trade policy, and so farmers are directly exposed to world markets with the associated changes in prices brought about by changes in consumer taste and government policy and climatic variations in competitor countries. Australian farmers must be adaptable and responsive if they are to survive.

There are sections of the agricultural industry which are sceptical: they say that farmers have always managed without much education. Historically, there has been an assumption that if you provide people with land they will know by instinct how to be effective farmers. Research has found that in the past, less academic sons have traditionally worked on and inherited the farm; they are less disposed towards formal courses which are viewed as too theoretical for 'practical' farming (Lees and Reeve, 1991). This quote describes farmers' perceptions of the relative importance of experiential learning and formal, institutionalised education:

> Most farmers continue to put local knowledge, the willingness to work hard (for extended hours) and the ability to work reliably without close supervision ahead of trade or university qualifications in farming when listing the important characteristics of a farm manager. (Moore, 1990, 5)

Farm businesses of all sizes are overwhelmingly family businesses; 99.6% of Australian farm businesses are family owned (Australian Bureau of Agricultural and Resource Economics, 1996). Attitudes of the family members who manage farm businesses are the key determinants of the level of education and training in the industry. Industry leaders are very interested in 'proving' that education and training have an impact on the responsiveness of farmers. They want to motivate all farmers to participate in education and training. Industry leaders also want

to persuade those with control over funding of the benefits of investing in agricultural education and training.

It is that high level of industry interest which initiated the research project of which the results presented here are a part.

Education and training and changes to practice

Those funding, running, facilitating and participating in training are involved because they expect the training to influence the behaviour of training participants, and hence impact on variables such as profit and sustainability of the farm business. The positive relationship between education and training and farm profitability is confirmed by data collected from the larger project of which a part is discussed in this paper (see Kilpatrick, 1997). This research showed that, for a given size of farm business (measured by value of assets), farm businesses with mangers who had participated in more education and training were more profitable than businesses with managers who had participated less. If education and training does impact on farm business outcomes such as profit and sustainability, then it is vital to understand how training impacts on farm management decisions.

Australian farmers have access to a wide variety of education and training sources. The training extension market was dominated by government departments of agriculture until the late 1980's when services initially changed from free to fee paying, and then were gradually reduced. Now there are many small private companies providing seminars, field days and (usually non-certified) courses. Educational institutions provide short courses, entry level training and some continuing education for farmers. Input suppliers and product purchasers play a significant role in education and training in only some relatively minor industries such as cotton and sugar cane. The distinction between education and training in the Australian context is blurred. Courses no longer have fixed durations, instead, certification is available at any time to anyone who can demonstrate 'current competence' in the areas relevant to the Certificate which they

seek (Australian National Training Authority, 1998). For this reason, the scope of 'education and training' investigated is broad, ranging from formal qualifications from agricultural colleges and other institutions to seminars and field days. It includes technical agricultural training (ranging from Agricultural Science degrees to field days), management training (university degrees to bookkeeping courses) and training in sustainable agriculture.

The questions addressed in this paper are:

What impact does agricultural education and training have on farm business practice?, and

How does training influence changes to farming practice?

The following section provides a brief overview of previous studies which examine how education impacts on farm business outcomes such as profitability; section 3. describes the methodology used in this study, section 4 presents results relating to the impact of education on farm business profitability, section 5 presents results on how education and training affect decision making and hence profitability and section 6 is the conclusion.

How does education and training impact on the farm business?

Education and training are widely acknowledged as contributors to national economic well-being and growth. Countries with higher levels of income generally have higher levels of education; human capital, which includes both formal education and informal on-the-job training, is a major factor in explaining differences in productivity and income between countries (Hicks, 1987). Two writers who stress the importance of education for a nation's economic success are Porter (1990), writing in his influential book, *The Comparative Advantage of Nations*, and Lundvall (1992), a Scandinavian writer and researcher on the role of learning in organisations and networks of organisations within nations:

> Education and training constitute perhaps the single greatest long term leverage point available to all levels of government in upgrading industry. (Porter, 1990, 628)

> First, it is assumed that the most fundamental resource in the modern economy is knowledge and, accordingly, that the most important process is learning. (Lundvall, 1992, 1)

Advances in knowledge (including diffusion of knowledge) is the most important of the factors which contribute to productivity growth, followed by changes in the quality of labour (of which education and training is the major component) according to a British study by Kendrick and Grossman (quoted in Blandy & Brummitt, 1990, 7). Specific, or on-the-job, training is an important factor in increasing productivity. A study by the American Society for Training and Development found that over half the productivity increases which occurred in the United States between 1929 and 1989 were due to learning on the job, and that people given formal workplace training have a thirty percent higher productivity rate (Business Council for Effective Literacy, 1993). According to the World Bank (1997) learning (which includes education and training) is the mechanism which has the potential to facilitate development and change of individual, work organisations and institutions.

Education and training is especially important for those functions which require adaption to change (Sloan, 1994; Chapman and Stemp, 1992; Bartel and Lichtenberg, 1987). The literature includes several studies which present and test theoretical models which suggest ways in which education and training impact on farm management behaviour, and hence on outcomes for the farm business such as profitability and productivity.

A seminal work on the way in which education impacts on behaviour, decision making, and hence outcomes, is Welch (1970), who finds that education can affect productivity via improved quality of labour and also via an allocative effect which is due to improved ability to

process information, select inputs and allocate inputs across competing uses. Huffman (1974) and Khaldi (1975) confirm Welch's (1970) finding that education improves the outcome of decisions. Nelson and Phelps (1966) and Thomas, Ladewig and McIntosh (1990) suggest that education assists people receive, decode and understand information, and hence make better decisions.

A number of studies suggest that the better educated are aware of a greater number of possible innovations through use of the mass media and contact with expert advisers (Rogers, 1995; Longo, 1990; Thomas, Ladewig and McIntosh, 1990; Riesenberg and Obel Gor, 1989; Jones, 1963). When combined with the enhanced ability to select the best of these innovations (see the previous paragraph), this awareness will lead to superior outcomes for farm businesses with better educated farm managers.

A final body of literature which suggests that education improves responsiveness and adaptability is that which concludes that education alters values and attitudes away from the traditional, and that change in attitudes encourages development (Foster, 1987; Holsinger, 1984). The interaction between participants which takes place during training time, before and after sessions and at breaks, allows individual farmers to compare their values and attitudes with group norms. Interaction with fellow participants and expert trainers or facilitators allows information to be gathered from a number of sources. The opportunity to alter values and attitudes in these ways increases the probability of a change to practice (Guba & Lincoln, 1989; Chamala, 1987; Phillips, 1987; Fliegel, 1956).

Methodology

This paper uses data from two sources; national data from an additional suite of questions on the Australian Bureau of Statistics' 1993-94 Agricultural Financial Survey, and data from an interview survey of 65 Tasmanian farmers. The unit of interest here is the farm business unit rather than the individual farm manager since more than three-quarters of farm business in

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Australia are run by two or more managers (see Kilpatrick, 1996) and the changes to farming practice apply to the whole farm, not to an individual farmer.

The approach taken here is to examine changes to farm management practice which the farm managers believe have or will improve farm business profitability. The changes nominated could have taken place at any time over the past three years. The changes may be to financial management, technical agricultural practices, land management, marketing or any other change which has or is expected to improve farm business profitability.

The Agricultural Financial Survey

The Agricultural Financial Survey (AFS) is an annual survey of farm business units conducted by the Australian Bureau of Statistics. In the majority of cases, farm business managers are interviewed face-to-face; remote farm businesses complete a mail survey form or are interviewed by telephone. Those interviewed answer questions on behalf of all people in the farm businesses, which is feasible because the vast majority of farm businesses are family businesses operated by between one and four family members (over 95% of businesses). The sample is a stratified one based on the value of operations by industry. The sample size in 1993/94 was approximately 2500 of an estimated farm business population of 107 538. Legislation requires that all those selected in Australian Bureau of Statistics' surveys must participate. Australian Bureau of Statistics (1995, 54) describes the sampling method.

An additional section of questions, entitled Changes to Farming Practice, was added to the 1993/94 survey. The section consisted of fourteen questions about changes to farming practice over the past three years, educational qualifications held by the farm management team, formal and informal training attended in the past year, including field days, and future training intentions.

Tasmanian interview survey

This is an interview survey of 65 Tasmanian farm businesses, 45 of whom were selected because a manager had completed one of three training courses, and 20 who had not completed those courses (but may have completed others) randomly selected from the approximately 3000 members of the Tasmanian farmer organisation. The method used is a semi-structured face-to-face interview. There are two sample groups. The first is participants in one of three courses in the previous four years and the second is a group who has not participated in one of these courses. Two of the three courses were delivered by local Technical and Further Education Colleges in off-campus, rural locations and the third was delivered by the government department of primary industry, also in rural locations. The duration of the courses was from 12 to 100 hours. Two of the courses were about dairy farm management and the third was a chemical handling course.

The Tasmanian survey provides more information about influences on the decision-to-change process than the Agricultural Financial Survey. It also provides data on how training programs impact on the decision making process, and allows comparison of those who attend courses of several sessions with other farm businesses. It should be noted that because of the way the sample was selected from those who had participated in education and training, the Tasmanian sample over represents farm business units which engage in training and those which make changes to practice, compared to the national (AFS) sample.

Training and changes to farm management practice

Over a period of three years, 62% of all farm businesses made at least one change to their farm management practices aimed to improve profitability, according to the Agricultural Financial Survey. There are very few studies which consider the general level of innovation of farm businesses. Most innovation studies in agriculture and other fields concentrate on the diffusion or adoption of a single innovation or a group of related innovations. Moore (1990) found that 16% of New Zealand farmers had never made a management change which lifted production

levels. Changes in the present study are restricted to those made in the last three years, and so the results were not directly comparable with those for Moore's open ended period. Weston and Carey (1979) found that 22% of Australian dairy farmers planned changes at the depth of the economic cycle, rising to 46% two years later on the upswing of the cycle. If the extent of innovation does move with the economic cycle, then the proportion of farm businesses which make changes to practice found here (62% over three years) could be at the low end of the range which occurs over the cycle. This is because the period 1991-92 to 1993-94 was one of low economic returns for agriculture (Martin, 1996), and so represents a low period of the farm economic cycle.

Educational qualifications and change

Farm businesses with no one in the management 'team' having education to year 10 level are the least likely to make a change to their practice (56% made no change to improve profitability in the last three years). Table 1 shows that the likelihood of making no change to practice is greater for those without post school qualifications than for those with post school qualifications. Farm businesses with a highest education level in the management team of year 10 to 12 comprise 43% of all farm businesses, or 1075 of the 2500 farm businesses surveyed. This group makes changes at the average rate for the farm business population.

Table 1 Education and percentage making a change by type of change (AFS data)

Highest education level in management team	Financial	Marketing	Technical agricultural	Land management	Average number of types of change
Below year 10	5%	6%	32%	12%	1.28
Year 10 to 12	13%	10%	48%	24%	1.53
Non-agricultural post-school qualification	16%	12%	57%	29%	1.58
Agricultural qualification	25%	19%	56%	35%	1.86
All farm businesses	**14%**	**11%**	**48%**	**25%**	**1.57**

Chi squared test probability for distribution of change/no change at each education level compared to Year 10 to 12 is less than 0.000001% for all four types of change.

Farm businesses with better educated managers are more likely to make all types of change. Table 2 also shows that, while those with below year 10 education are less likely to make any change to practice, the difference is less marked for technical agricultural change than for the other types of change.

Table 2 Training participation and changes to practice (AFS data)

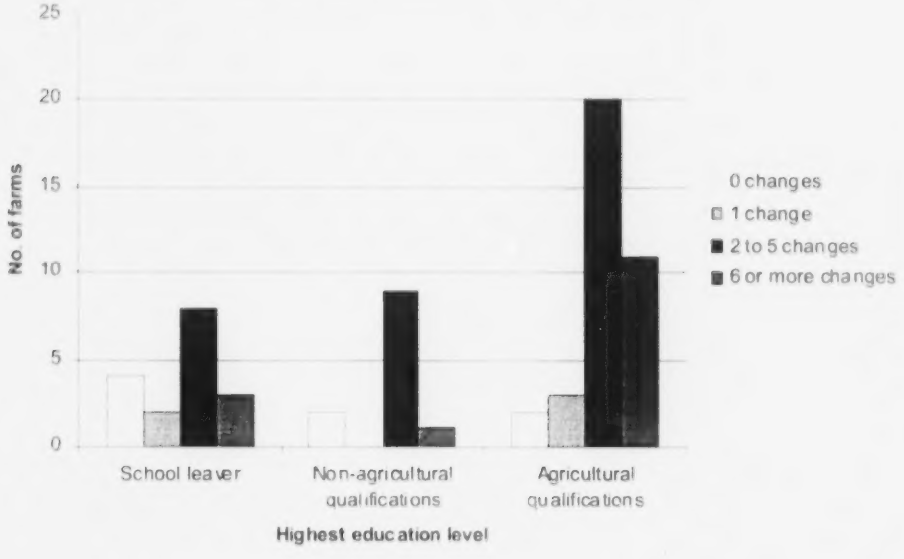
	% making a change
Farms which train	68%
Farms which do not train	39%

Chi squared probabilities for distribution of change/no change being the same is less than 0.00001%

Taking only businesses which do make changes, farm businesses with managers with formal agricultural qualifications from colleges of technical or further education or universities make a broader range of changes (an average of 1.86 categories), while farm businesses with the lowest educational qualifications which do make changes are least likely to make non technical changes.

Tasmanian data also show that farm businesses with agricultural qualifications in the management team are more likely to make changes, and are more likely to make two or more changes (Figure 1). Highest education level below year 10 is not shown separately as this sample is only 65, compared to the national sample of 2500, and only four farm businesses are in this category.

Figure 1 Number of changes and education level (Tas data)



Chi squared probabilities for distribution of education levels compared to agricultural education: school leaver 0.00153961%, non-agricultural post school qualifications 0.00041137%.

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Recent training and change

Those funding, running, facilitating and participating in training are involved because they expect the training to influence the behaviour of its participants, and hence impact on variables such as profit and sustainability of the farm business.

AFS data show that 68% of those farm businesses which participated in training in the past year had made a change to practice in the past three years. This is significantly higher than the 39% of non-training farm businesses which made a change to practice in that period (see Table 3). If current training behaviour is an indication of past training behaviour, as discussed below, then those farm businesses which trained in the last year also trained in previous years.

Eighty percent of Australian farm business participate in training (AFS data), however many of these attend only field days (25% of all farm businesses) and only 3% participate in courses of several sessions. Those farm businesses which participate in training are more likely to have made a change; 68% of those farm businesses which train also make changes to their practice, compared to only 39% of those who do not train (Table 3). Further, the AFS data show that those who attend training other than field days were more likely to make a change to practice than those who only attend field days and those who attend more training events were more likely to make a change than those who attend fewer events.

Table 3 Proportions of farm businesses by training and change (AFS data)

Change and training	55%
Change, no training	8%
No change, training	26%
No change, no training	12%
Change and non field day training	35%
Change, no non field day training	27%
No change, non field day training	11%
No change, no non field day training	27%

Does education foster further training?

Forty-one percent of all farm businesses identified at least one training event they would have liked to attend, but did not. These farm businesses tended to have more educated management teams than farm businesses which could not identify any worthwhile, but 'missed' training events. More than one quarter (27%) of those who missed no events also attended no events in the past 12 months. These farm businesses are 11% of all farm businesses. Those with a low level of education are over represented in this group which identified no training events as worth attending. Twenty-seven percent of farm businesses with no one with year 10 education or beyond fail to identify or attend any desirable training events, compared to less than ten percent of farm business with education beyond year 10.

As well, 31% of farm businesses in the lowest education category attend no training events, and plan no training in the next three years, again compared to less than ten percent of farm businesses with higher education.

Adult learning literature provides some reasons for the correlation between education levels and perceived need for further education and training. Low actual or perceived literacy levels and lack of confidence as a learner are barriers to participation in training. Lack of confidence as a

learner could be due to an unsatisfying or unsuccessful school experience or because of the length of time away from formal education (Salzberger-Wittenberg, Henry & Osborne, 1983 quoted in Tennant, 1991).

Training, change and profit

Farm businesses which both train and make changes to practice have a higher average gross operating surplus ($73 170) than other farm businesses ($55 335). Those which attend training other than field days and make changes to practice have an even higher average gross operating surplus ($83 651). Farm businesses which neither train nor make any changes to practice have a significantly lower average gross operating surplus ($31 580) than other farm businesses. Figure 2 shows the average gross operating surplus and 90% confidence limits for various combinations of training and change behaviour. Table 4 gives the proportion of farm businesses in each category. The relationship between training and profitability generally holds for farm businesses of all sizes, see Kilpatrick (1997) for a detailed discussion.

Figure 2 Profit and training and change (AFS data)

Table 4 Contribution to total farm profit by training and change behaviour (AFS data)

Training and/or change	Contribution to total farm profit
Training and change	64%
(Non field day training and change)	(47%)
Training, no change	24%
No training, change	6%
No training and no change	6%

There is evidence from the Tasmanian interview survey that a farm business's pattern of past training is similar to recent training participation (the correlation coefficient for training participation in the last year and training one to three years ago is 0.91). The Agricultural Financial Survey data show a correlation between recent training behaviour and future training plans (AFS data), which lends support to the idea that training behaviour is similar over time. If training does contribute to higher profit, then farm businesses with recent training are likely to have benefited from earlier training, and it is that earlier training which contributes to present profitability.

Contribution to total farm profit

Farm businesses which both train and make changes to practice represent 55% of all farm businesses (Table 4), but contribute 64% of total farm profit (gross operating surplus), see Table 5. The twelve percent of farm businesses which neither train nor make changes to practice contribute only six percent to farm profit.

Table 5 Prompts for change to practice (AFS data)

Prompt	% of changes
Training event	17%
Other farmers	18%
Family or staff	13%
Agricultural companies	7%
Consultants (inc financial)	8%
Government agencies	6%
Industry organisations	7%
Land management groups	2%
Media	2%
Financial reasons	3%
Other	18%

Prompts for change - Agricultural Financial Survey

Farm businesses were asked what prompted the change which they rated as most important for improving the profitability of the farm. Table 6 shows that other farmers are the most frequently cited prompt, followed by 'training events', (including courses, seminars, conferences and field days), then family and staff, and various classes of expert advisers. A large number of the 'other' prompts are specified as 'self', 'own idea' or 'no one'. External events such as drought, flood, hail and fire and other reasons including worn out equipment and retirement of a share farmer make up the 'other' category.

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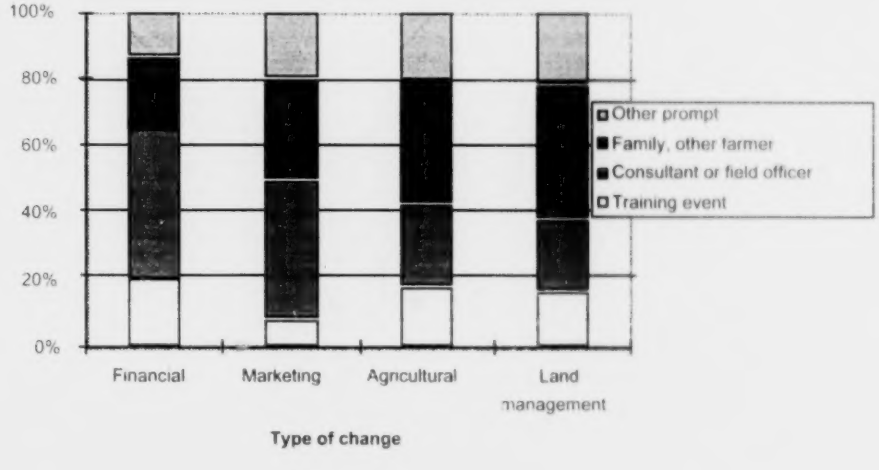
Table 6 Changes to practice influenced by courses (Tas)

Impact of course on change	Proportion of all course participants
Made a change influenced in any way by course	64%
Became aware of the change at course	20%
Course was trigger for change	27%
Change was one of two most important made on farm in last 3 years	16%
Total participants	45

Financial and marketing changes are most likely to be prompted by consultants, field officers, bank personnel or other expert advisers. Agricultural and land management changes are most likely to be prompted by other farmers or family. Training, including informal learning events such as field days, prompt 20% of financial changes, 18% of agricultural changes and 17% of land management changes (see Figure 3).

Figure 3 Prompts for change by type of change (AFS data)



Chi squared distribution of prompts within each type of change compared to each other type of change is less than 0.00001%.

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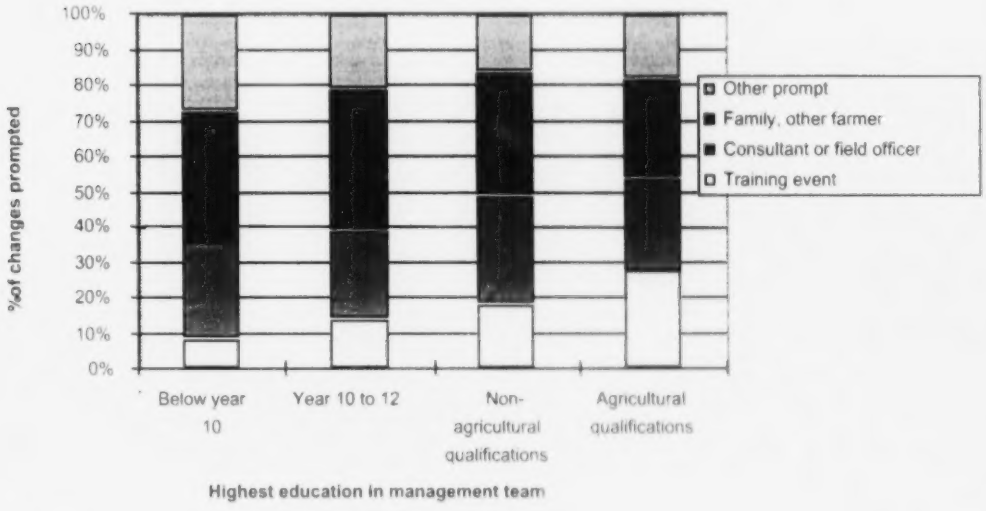
This finding of multiple influences on change is an important one for education and training practitioners. It was noted in the early part of this paper that interaction between program participants facilitates change. It is possible that programs which involve a number of trainers/facilitators/guest presenters may be more effective in bringing about successful change. Follow-up sessions held sometime after the initial course are potentially influential in change. Incorporation of field trips and other practical demonstrations into training programs would also increase the number of 'sources' which feed into the decision-to-change process. Further investigation is required to test these suggestions.

Prompts and education

Family, staff and other farmers are relatively more important in prompting change for farm businesses with no post-school educational qualifications in the management team. Those with only below year 10 qualifications are the most likely to have 'other' prompts for change, many of which are 'self' or 'none'. Training events prompt relatively more changes for those with post-school qualifications, while experts (consultants and field officers) prompt the smallest proportion of changes for farm businesses with agricultural qualifications (see Figure 4).

Figure 4 Highest education level in management team and prompt for change (AFS data)



Chi squared test probability for distribution of prompt categories compared to Year 10 to 12 is less than 0.000001% for each education level.

Tasmanian courses and changes to practice

Almost two-thirds of participants in the three survey courses made at least one change to their farming practice as a result of attending one of the courses. Changes are planned on two other farms. All but two of the farmers believe that these changes have or will improve the profitability or long term viability of the farm. (One of these two made a change for safety reasons, the other for legal reasons.)

Twenty percent of all the farmers who attended one of the courses became aware of a new practice or management strategy at the course and subsequently implemented that practice or management strategy. One of the courses was the 'trigger', or critical factor, in the decision to make the change in almost half of cases. One quarter of the course-influenced changes were rated the most or second most important change made on the farm over the past three years (Table 7).

Table 7 Changes to practice influenced by courses (Tasmania)

Impact of course on change	Dairy course participants	Pasture course participants	Chemical course participants	Proportion of all course participants (per cent)
Made a change influenced by course	8	12	9	64
Became aware of the change at course	2	5	2	20
Course was trigger for change	4	5	3	27
Change was one of two most important made on farm in last 3 years	3	3	1	16
Total participants	13	16	16	45 people

The types of change made as a result of the dairy farm management courses are largely changes to pasture planning or land management (these two changes comprise 85% of all changes from the two courses). Not surprisingly most of the changes as a result of the chemical handling course are to chemical usage (56%).

The most frequently reported reason for not making a change related to the course is that the course reinforced the appropriateness of existing practices (especially the chemical handling course). Only three people gave reasons related to the way the course was delivered.

Changes could occur because of the acquisition of new knowledge and skills at the courses. However, there usually need to be several influences on decision makers in order for a change to occur. As well as delivering new knowledge and skills, training courses provide an opportunity for interaction with other farmers and 'experts' such as extension officers and consultants. The interaction allows individual farmers to compare their values and attitudes with group norms and information to be gathered from a number of sources. The Tasmanian interview survey results provide evidence of the need for multiple influences in order for change to take place.

Conclusion

Thirty-eight percent of farm businesses (AFS data) made no change to their practice over a three year period. This three year period (1991-92 to 1993-94) was a time of rapid change in domestic and global markets, and a period of declining farmers' terms of trade and historically low real farm incomes (Martin, 1996). The farm businesses which made changes to practice will be better positioned to respond to changes, and survive and be profitable in the future.

Farm businesses which participate in training are more likely to make changes to their practice which are designed to improve profitability. Education and training impacts on the farm business via managers' awareness of a greater number of possible innovations, via improved decision making and allocation of resources, and via attitudes which encourage changes to practice. For these reasons, education and training is likely to facilitate successful changes to practice. So, it is successful changes which are the link between education and training and increased profitability. This is not to say that changes only follow education and training. Rather, those who participate in education and training are more likely to subsequently make successful changes to their practice, compared to the level of successful changes among those who do not participate.

Most changes to practice are influenced by interaction with, and information from, a number of sources, including peers, experts and training events. Family, staff and other farmers are relatively more important in prompting change for farm businesses with no post-school educational qualifications in the management team. Expert advisers, other farmers and training events were important at all stages of the decision-to-change process. They were major sources of awareness of subsequently implemented strategies and practices as well as major sources of influence on the decision to change. The opportunity for interaction with peers, family and friends facilitates changes in values, attitudes and beliefs. Indeed, interaction with such social and emotional connections may be necessary before change can occur. Interaction with peers also provides the opportunity for awareness of new practices (other farmers are identified as an important source of awareness of new practices).

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Education and training is one set of such sources of information, advice and influence on decision makers. Education and training is able to influence change in three broadly defined ways: first, by delivering new knowledge and skills; second, by providing interaction with 'experts' (that is, facilitators, trainers or teachers); and third, by providing opportunities for interaction with peers (that is, fellow training participants). Education and training presents opportunities for interaction with other farmers and with facilitators (who are also 'experts'), as well as opportunities for receiving new information.

This research found that multiple sources are required to 'prompt' change. Further research is needed into effective ways of designing education and training programs so as to introduce farmers to multiple sources of information, which they can use as they make decisions about changes and as they implement new practices.

Educators should design education and training programs so as to encourage opportunities for interaction and sharing of knowledge and skills. In this design format, education and training are most likely to facilitate changes in farm businesses. Further research is needed to investigate how best to structure education and training to incorporate opportunities for interaction. Opportunity for interaction is likely to be especially important in fostering changes to complex practices such as financial management and land management.

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